ISVHE
(ISV Hindcast Experiment)

Design and Preliminary results

ISVHE was initiated by an ad hoc group:
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Preliminary results were prepared by J-Y. Lee, B. Wang, and I-S. Kang

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ISVHE Major Objectives

1. Better understand the physical basis for ISV prediction.
2. Developing optimal strategies for multi-model ensemble (MME) ISO prediction system,
3. Determine potential and practical predictability of ISV in a multi-model frame work.
4. Identifying model deficiencies in predicting ISO and finding ways to improve models' physical parameterizations and initialization.

Experimental Design

EXP1: Control Simulation

Free coupled runs with AOGCMs or AGCM simulation with specified boundary forcing (e.g., observed SST and Sea ice distribution) are requested for at least 20 years. The period for the forced AGCM run should be consistent with the hindcast period

EXP2: ISO Hindcast

Re Forecast Period	**20 years from 1989 to 2008**
Initial Date	**Every 10 days on 1st, 11th, and 21st of each calendar month**
The Length of Integration	**At least 45 days**
Ensemble Member	**At least 6 members**
Initial condition	**Initial conditions may use one day lag or 12 hours**

EXP3: ISO Hindcast during YOTC Period

ISO hindcast experiment from May 2008 to Sep 2009.

Update: Model OUTPUT Data

One-Tier System

	Model	Control Run	ISO Hindcast		
			Period	Ens No	Initial Condition
ABOM	POAMA 1.5 (ACOM2+BAM3)	CMIP	1980-2006	10	The first day of every month
APCC (not collected)	CCSM3	CMIP (20yrs)	1981-2008		The first day of every month
CMCC	CMCC (ECHAM5+OPA8.2)	CMIP (20yrs)	1989-2008	5	Every 10 days
ECMWF	ECMWF (IFS+HOPE)	CMIP(11yrs)	1989-2008	15	The 15th day of every month
GFDL	CM2 (AM2/LM2+MOM 4)	CMIP	1982-2008	10	The first day of every month
JMA	JMA CGCM	CMIP (20yrs)	1989–2008	6	Every 15 days
NCEP/CPC	CFS (GFS+MOM3)	CMIP (100yrs)	1981-2008	5	Every 10 days
PNU (not collected)	CFS with RAS scheme	CMIP (13yrs)	1981–2008	3	Every 10 days
SNU	SNU CM (SNUAGCM+MOM3)	CMIP (20yrs)	1989-2008	1	Every 10 days
UH/IPRC	UH CM (ECHAM4+IOM)	CMIP	1989-2008	6	Every 10 days during MJJAS

Two-Tier System

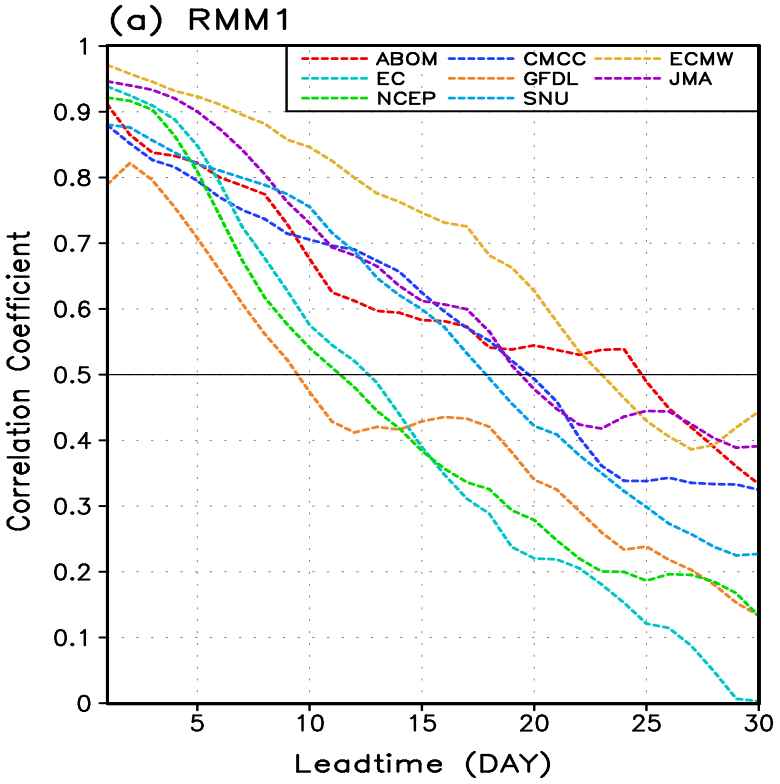
	Model	Control Run	ISO Hindcast		
			Period	Ens No	Initial Condition
CWB	CWB AGCM	AMIP (25yrs)	1981-2005	10	Every 10 days
MRD/EC	GEM	AMIP (21yrs)	1985-2008	10	Every 10 days
NASA/GMAO (not collected)	NSIPP	AMIP	1989-2008	10	Every day

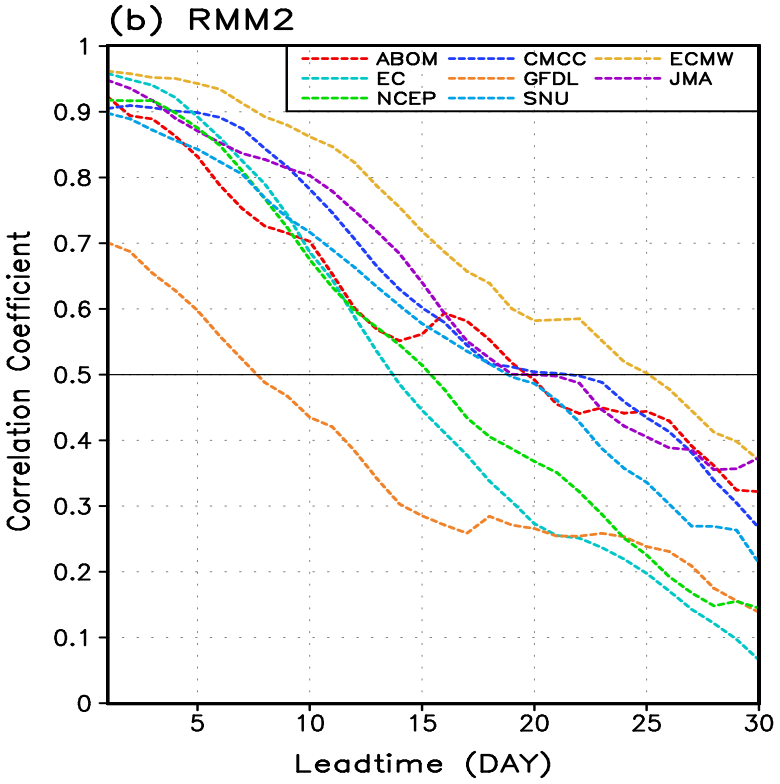
TCC Skill for RMM Indices/ ONDJFM

The next slice shows that

1.Seven Coupled Models exhibit a very large range of hindcast skills. The best model is ECMWF. There are three good operational models: Australian (ABOM), Japan (JMA), and Canada (EC). There are three relatively low performers: NCEP, GFDL, SNU.
2.Why? Besides model physics, initialization may be important. The NCEP model was initialized using NCEP2 reanalysis, which has poor MJO signal. SNU used NCEP 2 initial condition too. We hope to receive NCEP's new hindcast experiments with CFS initial conditions—the results may be better. We wonder how GFDL model initialize their model.
3.As shown by Fu et al., Using Interim ERA as initial condition the UH model shows much better results than using NCEP 2 reanalysis. (fig not shown) This suggests that improvement of initial conditions are a very important aspect of the ISO prediction.

TCC Skill for RMM Index/ ONDJFM: Individual models





- Evaluation of the temporal correlation coefficient (TCC) skill for the RMM1 and RMM2 using available hindcast data
- Validation dataset: NOAA OLR, U850 and U200 from NCEP Reanalysis II (NCEPII)
- Each model has different initial condition and forecast period.

In the next slice, only 6 coupled model were used for MME, because ECMWF model starts at 15th of each month and other 6 models starts from 1st.

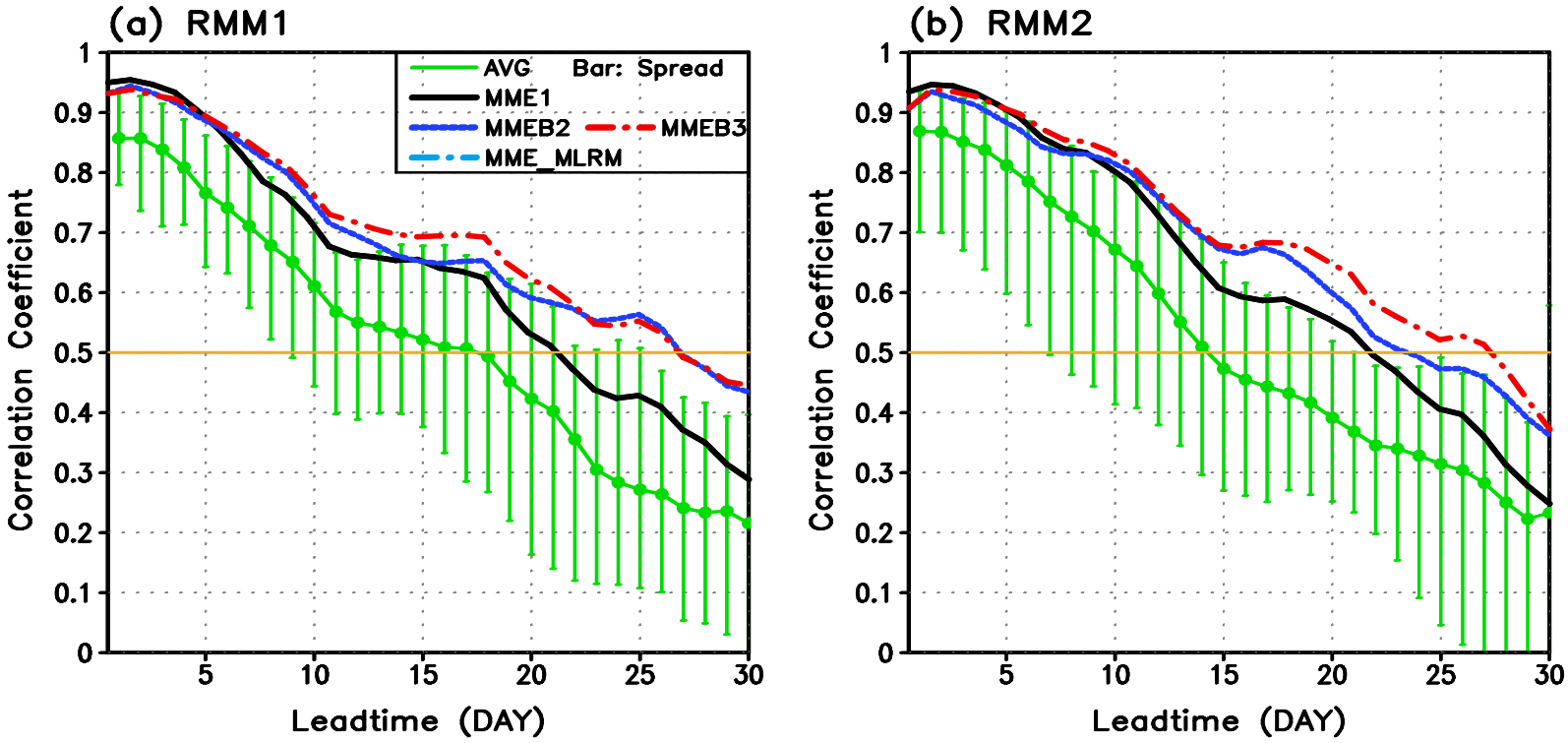
The results show that

1. 6-Model MME (simple average) is much better than averaged model skill.

2. The top 3 model average is better than all 6-model average, suggesting the quality of individual models are important for an improved MME.

3. The top three model MME shows TCC skill up to 4 weeks for both RMM1 and RMM2 modes.

TCC Skill for RMM Index/ ONDJFM: MME Hindcasts



Common Period: 1989-2008
Initial Condition: 1st day of each month from Oct to March
MME1: Simple composite with all models
MMEB2: Simple composite using the best two models, MMEB3: Simple composite using the best three models
MME_MLRM: MME with weighting ft.

Independent forecast (1999-2006) skill using MME_MLRM is not better than the simple MME skill.

RMMs Prediction with and without removing IAV component

In Wheeler and Hendon (2004) RMMs were identified with interannual component removed, i.e.,

1.Model's forecast climatology was removed at each forecast lead time.

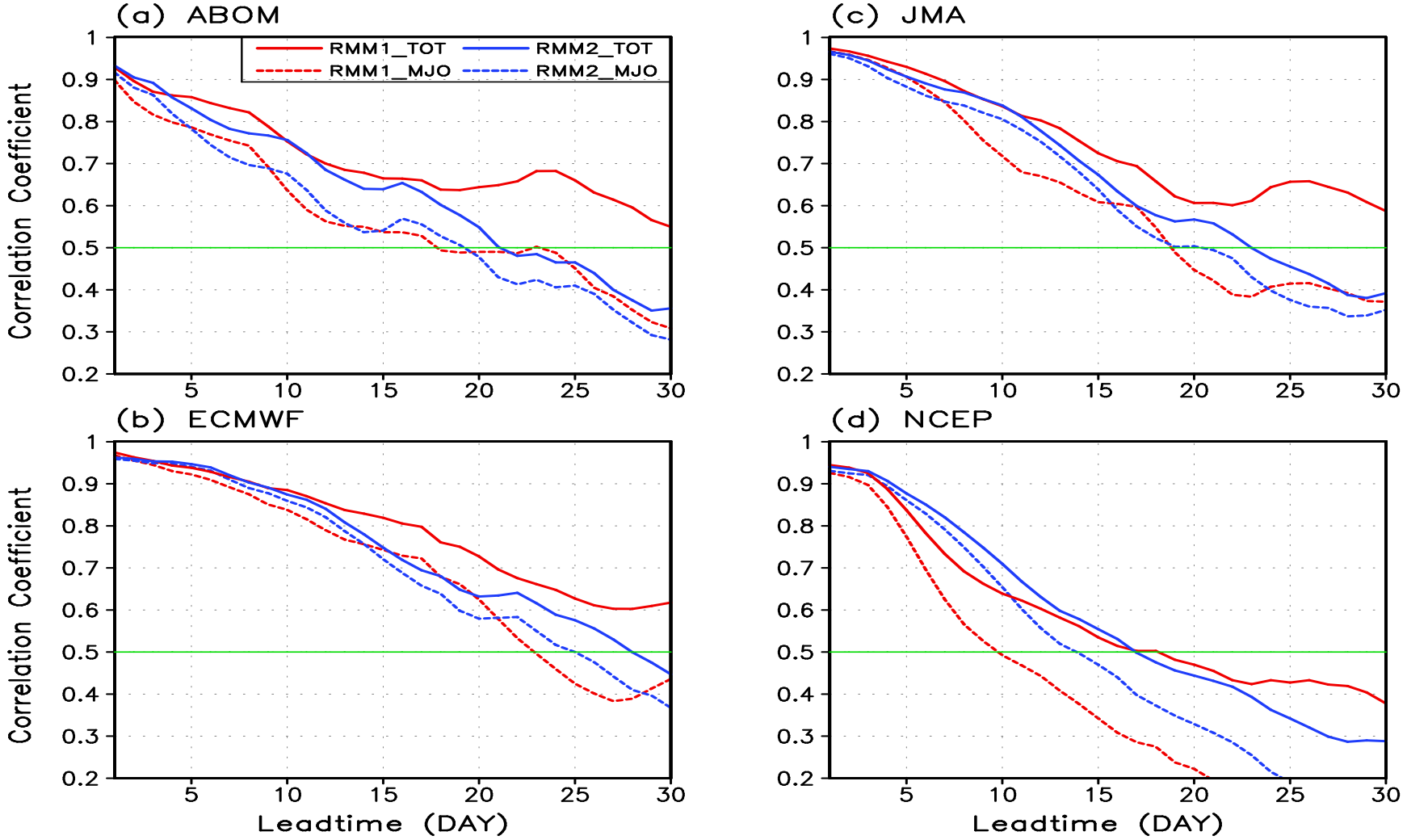
2. The interannual variation was removed through subtracting observed last 120 day was removed.

The next slice shows that the hindcast skill for RMMs without removing IAV component is much higher than the skill with IAV removed. This is true for all models.

I wonder whether in practical forecast we need to remove the IAV component. We also need to understand the causes of the different skills.

RMMs Prediction with and without removing IAV component

TOT: Without removing IAV; MJO: with removing IAV



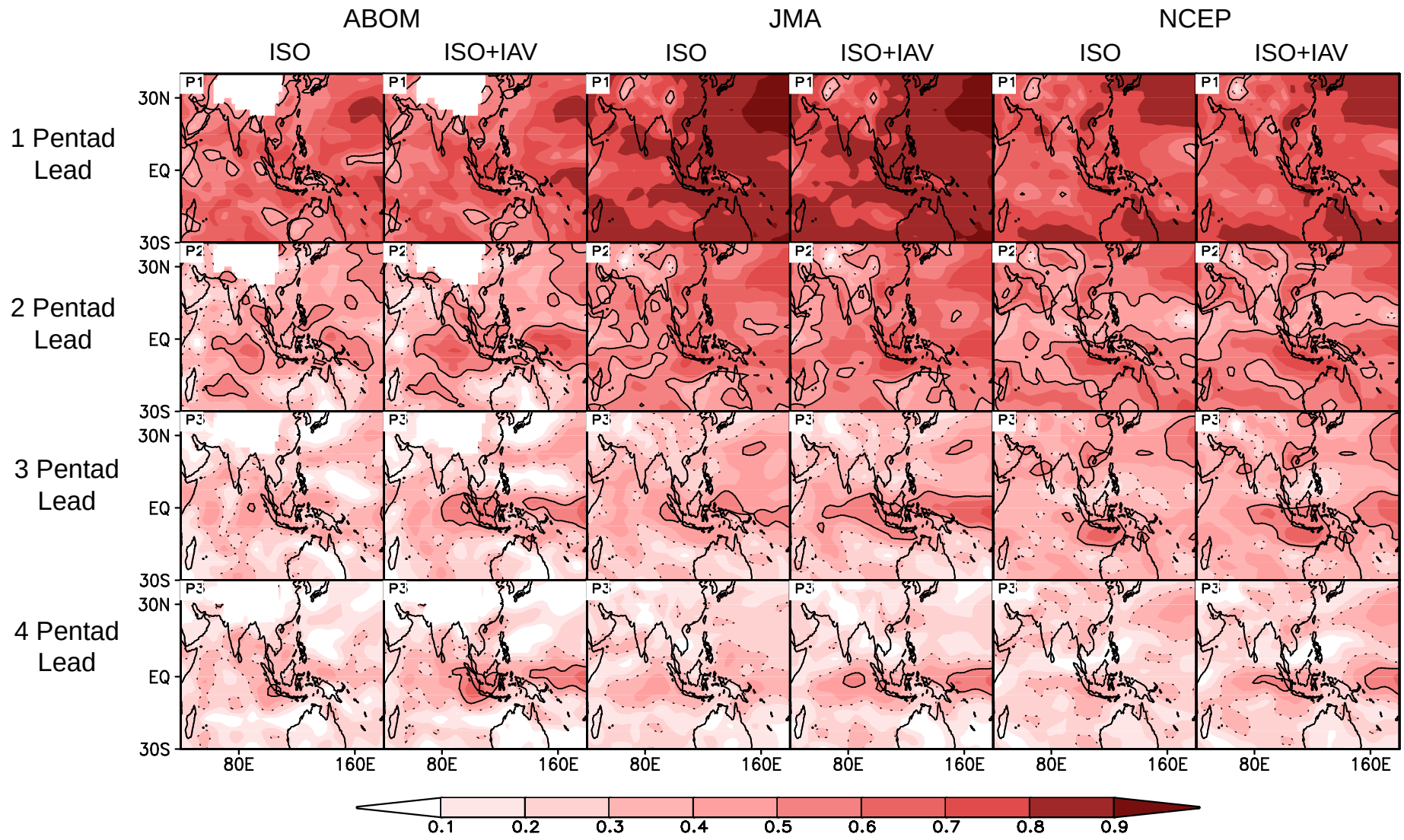
Pentad prediction skill may be a measure of the total ISV prediction skill, which is a more rigorous evaluation of the model's hindcast skill.

The following slice shows that All models have limited prediction skill after three pentads.

Shown is 850 hPa zonal wind field, which has higher hindcast skill than OLR and 200 hPa zonal wind (Figure not shown)

Pentad Forecast Skills of Coupled Models/ ONDJFM

Temporal Correlation Coefficient Skill for U850



Recommendation

1. **All CTB models perform hindcast experiments recommended by ISVHE. So far, only NCEP model has done so. Without ISVHE, it is impossible to make effective multi-model prediction of ISV.**

2. **Pay special attention to the initial conditions. Recommend use of Interim ERA as initial conditions for atmospheric model component. If other initial condition s are used, we recommend careful checking and making sure realistic MJO signals are present in the initial conditions (for instance check OLR data against observations.**

3. **The MJO Task force team should consider development of adequate metrics for evaluation of the ISV forecast skill at different levels.**